

**HORNED  
LIZARD**



**CONSERVATION SOCIETY**

Post Office Box 122, Austin, Texas 78767

# Phrynosomatics

The Newsletter of the Horned Lizard Conservation Society

Our purpose is to document and publicize the values and conservation needs of horned lizards, to promote horned lizard conservation projects and to assist with horned lizard management initiatives throughout their ranges.

Volume 10, Issue No. 2

May 2005

---

## Born Survivors

*A look at survival strategies and other behaviors  
of North American horned lizards*

by Wade Sherbrooke

*This article originally appeared in the January 2004 issue of REPTILES magazine - [www.reptilesmagazine.com](http://www.reptilesmagazine.com) - and is reprinted with permission.*

The 13 species of horned lizards have distributions spread across North America from the U.S. border of western Canada southward to Mexico's western border with Guatemala. They represent a somewhat uniform group of lizards that are faced with a changing array of potential predators over time and from location to location.

Horned lizards are plump in outline and flattened against the ground. All have some degree of horns protruding from skull bones around the rear of the head and spines over their eyes, as well as spiny scales spread over their upper body. The top (rough) and bottom (smooth) surfaces of each lizard are separated or delimited, in all but one species, by elongated spiny scales in a single or double row of fringelike extensions of the body's edge. All of this appears carefully designed by natural selection to reduce the

probability of these lizards becoming meals for a broad array of predators with diverse abilities of locating and capturing them.

### **Outta Sight**

For a horned lizard, the best way to avoid predation is to go unnoticed.

Predators have a "search image" in mind when looking for food, and nothing puts a potential meal on a predator's radar screen like motion. When a horned lizard feels threatened by motion in the distance, it intuitively freezes on the spot or seeks cover. Then, its form-and-color pattern come into play, in essence, trying to outperform the predator's detection abilities. Horned lizards lie motionless, flat on the ground, their color patterns breaking up their image into multiple pieces that are not easily translated into a whole animal. The dark-and-light bands and

spots appear as shadows and pieces of material on the ground, or slight irregularities in the landscape. The flat shape of most horned lizards aids them in blending their image into the surface background. Their sides slope down to the ground, where a row or two of lateral fringe scales make the final visual transition to the soil surface. These pointed, extended scales are often light in color, breaking up and masking the natural dark-shadow line that would otherwise facilitate the predator's visualization and recognition of the outlines of a meal.

### **Optical Illusions**

Some horned lizards have special features that enhance their camouflage through visual tricks. Two species appear to use a line down the middle of their back to accomplish this deception. One is the

*continued on page 4*

---

# National Board of Directors

---

## President

Wendy L. Hodges  
Department of Science and Mathematics  
University of Texas of the Permian Basin  
4901 East University Blvd.  
Odessa, TX 79762  
(432) 552-3265  
hodges\_w@utpb.edu

## President-Elect

*vacant*

## Treasurer

Roger Repp  
c/o NOAA  
950 N. Cherry  
Tucson, Arizona 85719  
repp@noao.edu

## Member Services

Bette Armstrong  
6612 Dayla Ct.  
Granbury, TX 76049  
jimbett@charter.net

---

***On the web at – [www.hornedlizards.org](http://www.hornedlizards.org)***

---

## New Mexico Chapter

Tom McCain, President  
PO Box 53095  
Albuquerque, NM 87112  
htinc@juno.com

## Southern California Chapter

Lester G. Milroy III, President  
14321 Ricaree  
Apple Valley, CA 92307  
(760) 946-1094  
les4toads@aol.com

## Oklahoma Chapter

Richard Stark, President  
1820 Lexington Rd  
Claremore, OK 74017  
starkkrv@prodigy.net

## Texas Chapter

Lee Ann Linam, President  
Wildlife Diversity Branch  
Texas Parks & Wildlife Dept.  
200 Hoots Holler Rd  
Wimberley, TX 78676  
lalinam@wimberley-tx.com



***Please send Membership Applications or Requests for Information to:***

**HLCS  
P.O. Box 122  
Austin, TX 78767**

## *Phrynosomatics* Editors

### *Copy Editor*

Leslie Nossaman  
LNNO@chevrontexaco.com

*Please contact Leslie to submit an article or photograph for the newsletter!*

### *Design Editor*

Pamela S. Allison  
PO Box 30939  
Amarillo, TX 79120  
(806) 656-0036  
psallison@earthlink.net

---

# A little Horned Lizard takes a trip

---

by Anthony C Hotopp Secretary of the New Mexico HLCS

This true story is about a horny toad (HT) that we will call Harriet for convenience. Harriet is a short horned lizard of the species *Phrynosoma hernandesi*. She was found near the city of Carrizozo, which is in the southeastern quadrant of New Mexico. A family on vacation found her, instantly fell in love with her, and decided to take her home as a pet. This is a common occurrence, wherever horny toads are found and is a factor in the disappearance of our little friends.

The common public is not aware of how badly our little horny toads have been depleted. To a child, horny toads may look like a little dinosaur and the wonder in the child's eyes is worth a thousand pictures. *Therein lays the problem, folks.* You cannot take a child to a pet store and say 'there is a horny toad'. Most zoos do not keep them because they cannot keep them alive. Twenty to 30 years ago horned lizards were in abundance and today's parents have fond memories of them. Therefore, parents of all ages when encountering a horny toad in the wild is likely to have one thought in mind: "My kids have never seen a horny toad. I should take this home for them."

*Horny toads die in captivity  
and it is not a question of 'if,' but of "when."*

We know now that horny toads have a 'home range,' that includes many anthills (the number varies between individuals, species and habitat), and averaging anywhere from two to four acres. Most species of horny toads live their entire life in a relatively small area and rarely stray out of it for any reason. Some species, like the flat-tailed horned lizard, are known to go on long excursions outside their primary home range, but they do return.

The Arizona Southwestern Research Station did extensive studies on horned lizard displacement, studying up to 30 horny toads of different species at a time. Horny toads were removed anywhere from 50 yards to a couple of miles from their home ranges. They were tagged, fitted with a radio transmitter or marked. Within a few days a majority of them were dead. The most common cause was falling prey to a predator in the first 72 hours. It is not known exactly why, but others seemed to stop eating and let themselves die. None of them ever found their way back to their home range. From this it was postulated that they do not possess a homing sense over an area larger than their home range. It is general knowledge that even a horny toad removed only the length of a football field (50 to a 100 yards) rarely will be able to find its way back. Although a few displaced horny toads may survive a few years after acclimating to the new area, they rarely live out their full natural lives.

However, the incidence of this happenstance among horny toads put into a terrarium or artificial environment is undeniable. In captivity, they might eat at first, but usually stop feeding, and waste away. This can happen fairly quickly or take weeks to months, depending on how active they are, the reserves they have, and how warm their artificial environment is.

Now back to Harriet. Harriet was not only displaced from her home range but from her entire state. The family who found her was on vacation from Texas. It did not take the family long to realize that they had bitten off more than they could chew. After all, what do you feed a horny toad? Do they need a light, heat rock, and water dish? Calling several pet shops, they realized that nobody seemed to have answers. They called the zoo in desperation, for surely the zoo would know or perhaps be able to take care of her. Imagine their shock when told that the zoo could not take it, did not want it, and could not keep it alive. There are a few zoos in Texas that will accept one; however, this is the exception, not the rule.

It was probably with great relief that the family found there was a Horned Lizard Conservation Society that might help. They contacted Cheryl Franks of the HLCS and laid their problems at her door. She contacted Tom McCain, the president of the New Mexico chapter. After many discussions, it was decided that Harriet should be shipped to New Mexico and returned to the wild. The best-case scenario would be to quickly return her to within 50 yards of her original territory.

After careful packaging from Cheryl, an expert at handling horned lizards, Harriet was shipped via overnight mail. Harriet was received in good order and found by Tom and me to be a healthy specimen and very active (which is always a good sign). It was now time to return her to the wild.

She was in good health and young enough to perhaps survive the transition. Our best wishes go with her and we hope she will live a long life and produce more offspring. However, the real point is that the public must be educated about our little friends and the more people we can reach, the better. Not all these stories have such a happy ending. People need to know that it is okay to observe horned lizards and that they are not dangerous, but that they need to be left in place.

Personally, I am attempting to put together a lecture including pictures, artificial replicas of horned lizards, and enough material to do lectures at schools. If we can reach the adults through young people, then our job is well done. I hope that perhaps others will help to get the message out. In addition, I turn every teacher I meet to acquiring *Horned lizards in North America*, the wonderful book written by Wade Sherbrooke. Educating the public is a big job; however, it is one I approach with excitement, for everyone I reach is one more person who will be aware of the horned lizards plight.

*Thank you to the family and Cheryl Franks for the return of Harriet to the wild and to Wendy Hodges, Bill Brooks, and Tom McCain for providing input for this article. – ach*

juvenile Texas horned lizards by chewing through their skulls above the eyes. The outcome of such encounters with adult Texas horned lizards is not so clear, however. They have strong, bone-backed spines above the eye socket that chewing by these predators cannot penetrate. They also resist by hissing, inflating their bodies, opening their mouths and charging the mice. As in so many predator-prey encounters, the final outcome depends on the relative sizes of the lizards and predators involved.

If discovered by a foraging predator during the day, a horned lizard may run, trying to position itself below or behind the cover of a plant or rock. Most predators can outrun a horned lizard (except rattlesnakes, which don't give chase), but a quick, short sprint gives them a second chance at their visual-disappearance act. Motion followed by abrupt stillness, on a background into which the lizard blends, is very difficult for a predator to follow. The challenge for the predator is to keep the darting prey in focus. If the predator loses sight for a second, it may well lose its meal.

### Reptilian Predators

For predators that must swallow their prey whole, such as snakes and lizards, the size of a horned lizard becomes an immediate problem. Every snake has its own maximum size food item for safe ingestion, and this must be weighed against the size of the horned lizard being considered. Horned lizards' head spines

be firmly covered to thwart neighborhood predatory animals, such as cats, skunks, raccoons, hawks, or ravens.

This can be done with a 2 x 4-inch board frame covered with 1 x 1 1/2-inch welded wire, with solid areas for shade. This cover can be held in place by drilling holes through the 2 by 4s, into the top of the 2 by 12 sides, and dropping large nails loosely into each hole, thus preventing lateral movement. Pulling the nails out allows removal of the cover to access the lizards. Feeding, at one end of the cage, and sprinkling of water for drinking is easily accomplished through the screened cover. Lizards can be hibernated for six months at refrigerator temperatures.

*This article originally appeared in the January 2004 issue of REPTILES magazine—[www.reptilesmagazine.com](http://www.reptilesmagazine.com) – and is reprinted with permission.*

complicate this "swallowing calculation," and a horned lizard can bring its horns into play during such encounters, tipping its head forward to raise them.

Rattlesnakes envenomate horned lizards before trying to swallow them. Even then, the snake may become a victim, dying with a spiny horned lizard firmly lodged in its throat. Leopard lizards can only engulf juvenile horned lizards, or perhaps adults of the smaller species, after suffocating them with thoracic compression in their jaws.

With nonvenomous snakes, a horned lizard may use its back as a shield. This is done by pulling its ribs forward, which spreads the lizard's back wide and flat, and then tilting its body – the side farthest from the snake – upward, with its nearer side held almost against the ground. As the snake seeks an attack angle, the lizard shuttles its body into new positions, keeping its expanded surface square in the face of the snake, whose jaws will not be able to grasp

around the edges of the lizard. (If the lizard remained flat to the ground, the snake could easily get one jaw above and another below its lateral edges, thus securing a firm hold.) The snake often decides that a horned lizard exhibiting this behavior is not going to become a meal and departs.

### When Birds Attack

A horned lizard's defense toward a roadrunner is very similar to that used with a nonvenomous snake, but this avian predator has other skills. Holding the lizard in its beak, it will swing the lizard up into the air and smash it back into the ground. This is repeated numerous times until the lizard is killed. Then, swallowing proceeds, with careful attention to the downward projection of the horns so as to reduce potential damage to the bird's internal organs.

Shrikes capture small horned lizards, sometimes impaling them on a shrub thorn to dry. They also serve as advertisements to female shrikes of the territorial male shrike's hunting prowess.

*continued on page 8*

# TEXAS CHAPTER NEWS

## ***Pack your bags for Lubbock!***

The Texas Chapter will be holding a members' meeting in conjunction with a HLCS horned lizard management workshop at Texas Tech University on June 4-5. *See the announcement to the right and watch the HLCS website for details.*

***On the horizon:*** Bill Brooks is planning an exciting ***Horned Lizard Art Show*** for February 2006 at Wild Basin Preserve in Austin. Bill is working on a lot of great ideas – such as a juried art show and perhaps a local children's art contest. Please let Bill know if you'd like to help with some of his exciting ideas – some of which are beginning to unfold! *Contact him at [bgbrooks@mail.utexas.edu](mailto:bgbrooks@mail.utexas.edu)*

***Love that field work!*** As this newsletter goes to press, we're pursuing some dates and locations for horned lizards field surveys this summer. Please drop Lee Ann an email if you'd like to receive updates about field excursions that may be scheduled before the next issue. *Contact her at [lalinam@wimberley-tx.com](mailto:lalinam@wimberley-tx.com)*

## ***Mark your 2005 calendars for these events!***

Saturday, September 3 – Horned Toad Fun Day at Kenedy, TX

Saturday, September 17 – Old Rip Festival at Eastland, TX

*Contact Carrie Goodman or Kelly Armstrong at 254-629-2332 for additional information about the Ol' Rip Fest..*

Saturday-Sunday, October 1-2 – Texas Wildlife Expo at Austin, TX

***We need booth sitters!***

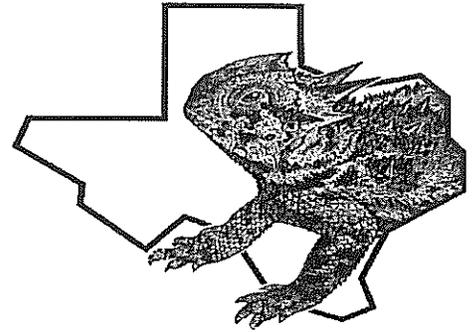
***Contact us to volunteer or for additional details!***

***Space in the June 4-5 Workshop is limited,  
so reserve your spot by May 15***

*by email to*

***[lalinam@wimberley-tx.com](mailto:lalinam@wimberley-tx.com)***

*or by returning the registration form below by mail  
photocopies of the form are acceptable*



## **ANNOUNCING A WORKSHOP**

**Horned Lizard Conservation  
and Management in Texas  
June 4 – 5  
Texas Tech University  
Lubbock, Texas**

Saturday afternoon will feature presentations about research about distributions, management, and reintroduction of horned lizards, along with discussion groups and a Texas Chapter business meeting.

Sunday morning will feature a horned lizard field survey at a nearby ranch.

Registration costs will be \$10, however, students may attend free.

*Additional details about the workshop and information about lodging will be forthcoming on the HLCS website  
or  
may be requested by mail.*

### **Workshop Registration: Horned Lizard Conservation and Management in Texas**

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Address: \_\_\_\_\_ Email: \_\_\_\_\_

\_\_\_\_\_ \$10 Registration (payable to HLCS) enclosed:

\_\_\_\_\_ Yes / No

Mail registration by May 15 to: Lee Ann Linam, 200 Hoots Holler Rd., Wimberley, TX 78676

Ravens feed horned lizards to their young in the nest, using their tough beaks to rip the entrails from the lizards' bodies. The spiny carcasses are discarded below.

### Here's Blood in Your Eye

Many horned lizards have a highly unusual defense against coyotes and kit foxes: They will eject blood from their eyes.

This strange defensive phenomenon has been known since pre-Columbian times, in what is now Mexico, when stories were circulated of lizards that "cried tears of blood." Later, in 1870, Alfred Russell Wallace's brother, John, wrote home to him in England, from California, about seeing blood squirted from the eyes of horned lizards.

Herpetologists have had numerous hypotheses regarding this phenomenon. They have suggested it might be an insignificant side result of the molting of skin, a way to reduce high internal temperatures, the result of blood-vascular damage attributable to blood parasites, or a way of repulsing predators.

There were many questions. If defensive, then is the blood dangerous, distasteful or poisonous? If so, is this true of circulating blood, as well, or only of squirted blood, to which some chemical may have been added by tissues surrounding the eyes? How would a lizard ever generate the blood pressure in its head to squirt a stream of blood six feet? And what would the target be?

continued next page

## Quick Guide to Horned Lizards

If you know where a horned lizard lives, the task of identifying it is much easier if you have a map of the distributions of the species. This can reduce the possibilities from 13 to four or less, often to one or two.

### Texas horned lizard (*Phrynosoma cornutum*)

This is the only species with a white stripe down the middle of the back and dark vertical lines between the jaws and the eyes, crossing over the head. Distributed westward from Kansas, Oklahoma and Texas into southeastern Colorado, New Mexico and southeastern Arizona, and southward into northern Mexico.

### Flat-tail horned lizard (*P. mcallii*)

Only species with a black stripe down the middle of back, base of tail flattened, horns long and narrow. Found only in southeastern California, southwestern Arizona and adjacent Mexico.

### Roundtail horned lizard (*P. modestum*)

Only species with no fringe scales along the side of the abdomen. Four short horns of equal size point backward along rear of head. Found throughout western Texas, extreme western Oklahoma and southeastern Colorado, through New Mexico into southeastern Arizona, and into the Chihuahuan Desert areas of northern Mexico.

### Regal horned lizard (*P. solare*)

This species has the most impressive continuous ring of horns of graded size around the head, going from one side to the lower jaw of the other side. The real cranial horns are the largest, with the bases of all in near contact. A Sonoran Desert species restricted in distribution to Arizona and adjacent coastal areas of Mexico.

### Pygmy horned lizard (*P. douglasii*)

Very similar to the short-horned lizard in appearance, but adults are much smaller. Cranial horns are very short and midline separation of area between horns is broad. Not overlapping in distribution with the short-horned lizard, only found in Washington, Oregon, Idaho and northernmost California.

### Short-horned lizard (*P. hernandesii*)

The head carries short stump horns, separated along the midline by an empty space that extends forward Ñ a notch Ñ giving the head a broad, arrowheadlike appearance. The back has a banded color pattern that is highly variable, colors depending on local background. Found from Canada and Montana southward through Arizona and New Mexico into northern Mexico, often at higher elevations.

continued next page

## **Quick Guide to Horned Lizards (continued)**

### **Desert horned lizard (*P. platyrhinos*)**

Only one row of fringe scales along each side of the body. Coloration is highly variable, depending on the local background. Broadly distributed in the arid basins west of the Rocky Mountains, from the Oregon-Idaho border southward into Nevada, Utah, California and Arizona, and into northwestern Mexico.

### **Coast horned lizard (*P. coronatum*)**

Two rows of fringe scales along each side of the body. Horns are robust and somewhat flattened, dark color bands across the back. Distribution limited to western California and Baja California in Mexico.

### **Rock horned lizard (*P. ditmarsii*)**

Tail very short, with short horns and jaws deep at the back of the head. Prominent horn above each eye. Only known from isolated locations in Sonora, Mexico.

### **Bull horned lizard (*P. taurus*)**

Tail very short. Horns at back sides of head fused into a long horn at each side, giving appearance of a single horn projecting back from each side of head. Only found in southern Mexico, in the states of Oaxaca, Puebla, Guerrero and Morelos.

### **Short-tail horned lizard (*P. braconieri*)**

Tail very short. Horns separate and well developed, not short and stubby or fused. Distribution is restricted to the southern Mexican states of Puebla and Oaxaca.

### **Giant horned lizard (*P. asio*)**

Body large and slightly elongate, bold brown-and-tan pattern. Central cranial horns erect, as are the prominent horns above the eyes. Spines on the back are large, distinct and erect. Tail is long. Found along the southwestern coast states of Mexico, from the Guatemala border northward through Chiapas, Oaxaca, Guerrero, Michoacán, Jalisco and Colima.

### **Mexican-plateau horned lizard (*P. orbiculare*)**

Tail and horns of normal size and form. Single row of lateral fringe scales on sides. Found at higher elevations throughout the plateaus and mountains of central Mexico, from Puebla and Guerrero in the south to Chihuahua and Sonora in the north.

This article originally appeared in the January 2004 issue of *REPTILES* magazine – [www.reptilesmagazine.com](http://www.reptilesmagazine.com) – and is reprinted with permission.

Dr. George A. Middendorf, of Howard University, and I have been working on the blood-squirting phenomenon in Texas horned lizards since 1989. Our initial experiments using a dog offered the first clues. Previously, I had noted during experiments that the frequency of blood-squirting responses by Texas horned lizards to road-runners and grasshopper mice was zero. However, in our experiments, all of the first 10 Texas horned lizards encountering an interested dog squirted blood within one minute. Humans picking up Texas horned lizards on roads were rewarded with only 5.9 percent of the lizards squirting blood. Therefore, the lizards seem to respond selectively to different predator threats.

How could blood distract or drive away a fox or coyote? The pressurized squirt of blood is generated by a part of the lizard's muscular anatomy and has been understood since 1907. At strategic points in the venous flow of blood from any lizard's head, there are sphincter muscles surrounding specific veins. When these muscles contract, squeezing the walls of the vein together, there is a backup of blood pressure in the head. This causes the capillary tissues surrounding the lizard's eyes to swell with blood and the eyelids to protrude. Typically, lizards use this raised blood-pressure mechanism to clean the eye area of dirt particles wiped off the surface of the eye by their nictitating membrane. However, horned lizards have adapted this mechanism for still another

function – delivery of distasteful chemicals into the mouth of an attacking predator, such as a kit fox.

### After the Squirt

Effective use of this response requires a horned lizard to innately distinguish between predators, for blood squirting would have little or no effect on an attacking roadrunner, for example. Recognition of the correct application of this defense seems to be mediated visually. Certain horned lizards see a fox or dog and “know” how to respond. Typically, they wait until the last second to squirt blood. The canid is usually in the process of feeling out the lizard with its jaws, and the blood is squirted directly into its mouth. Chemicals in the blood stimulate receptors in the mouth, not those around the eyes.

The canid’s reaction is one that suggests distaste: sideways and rapid head shaking, repeated opening and closing of the mouth, and wiping its jaws into the grass to clear the blood from its mouth. There is no apparent lingering physiological effect (sickness or vomiting). But there may be a psychological one. Does the fox or coyote want this animal in its mouth again? Probably not, unless it is very hungry.

The chemicals to which the canid is responding are found in circulating blood, as well as in squirted blood. This conclusion is based on tests we did with both types of blood and the responses of kit foxes. Thus, nothing chemically significant is added to the

blood by tissues around the eyes. Having such a distasteful chemical in its blood might give some protection to a horned lizard when bitten and bleeding, but how much better to deliver it, full strength, directly to the enemy’s taste buds before the attack results in significant injury or death.

Our recent studies suggest that all species of horned lizards do not squirt blood with the same frequency at canids or humans; some perhaps don’t squirt blood at all. Or, is it that we just don’t know what conditions are necessary to trigger blood squirting in these species?

Future research may answer this question.

### Survivors’ Club

As you can see, horned lizards have developed an arsenal of defensive strategies to thwart a variety of predators that live by their sides. But when it comes to antipredator response, one may be effective and life saving in dealing with one predator, but not so with another. Basic to the survival of individuals of each species is their having a wide selection of antipredator responses that can be applied in identifiable threat situations. A particular response may not always work for every individual, but when it does, a successful defense opens the possibility that, through reproduction, it will become more common in future generations.

Today, we see the results of some of those evolutionary workings and try to under-

stand at least the outlines of what is going on.

Understanding how much more is really happening as each horned lizard meets its challenges of potential predators, many of which we may not now recognize, is a challenge.

***It makes one wonder,  
just how well  
do we understand  
the world we live in?***

*Wade C. Sherbrooke is the Director Emeritus of the Southwestern Research Station, American Museum of Natural History, Portal, Arizona.*

*His book **Introduction to Horned Lizards of North America** was published by The University of California Press in 2003.*

### In Memoriam

The HLCS family deeply regrets the passing of Claude D. Roach, the husband of author and HLCS member Joyce Ann Gibson.

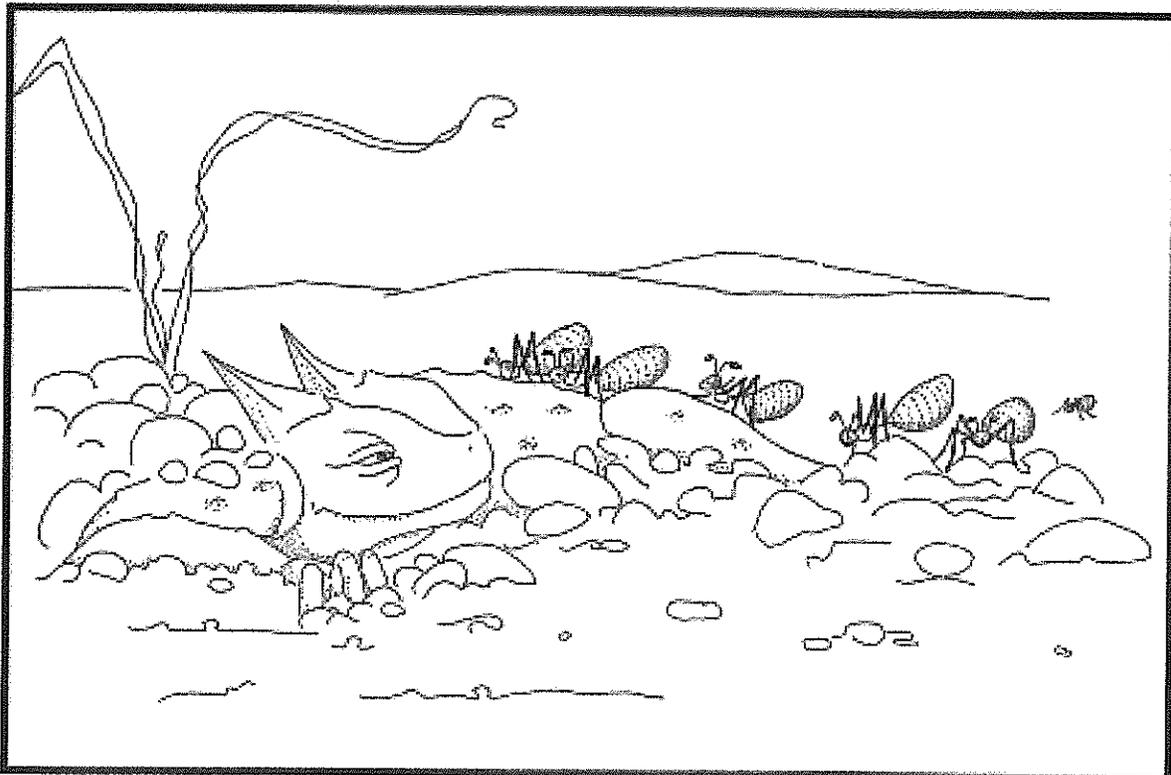
*Our thoughts and prayers go out to you, Joyce, as well as to your children and grandchildren.*

# Recent scientific publications about horned lizards

- Agosta, S. J., and A. E. Dunham. 2004. Comment on "How the horned lizard got its horns". *Science* 306.
- Clemente, C. J., G. G. Thompson, P. C. Withers, and D. Lloyd. 2004. Kinematics, maximal metabolic rate, sprint and endurance for a slow-moving lizard, the thorny devil (*Moloch horridus*). *Australian Journal of Zoology* 52:487-503.
- Hodges, W. L. 2004. Evolution of viviparity in horned lizards (*Phrynosoma*): testing the cold-climate hypothesis. *Journal of Evolutionary Biology* 17:1230-1237.
- Hodges, W. L. 2004. Defensive blood squirting in *Phrynosoma ditmarsii* and a high rate of human-induced blood squirting in *Phrynosoma asio*. *Southwestern Naturalist* 49:267-270.
- Hodges, W. L., and K. R. Zamudio. 2004. Horned lizard (*Phrynosoma*) phylogeny inferred from mitochondrial genes and morphological characters: understanding conflicts using multiple approaches. *Molecular Phylogenetics and Evolution* 31:961-971.
- Lomolino, M. V., and G. A. Smith. 2004. Terrestrial vertebrate communities at black-tailed prairie dog (*Cynomys ludovicianus*) towns. *Biological Conservation* 115:89-100.
- Meyers, J. J., and A. Herrel. 2005. Prey capture kinematics of ant-eating lizards. *Journal of Experimental Biology* 208:113-127.
- Newbold, T. A. S. 2005. Desert horned lizard (*Phrynosoma platyrhinos*) locomotor performance: The influence of cheatgrass (*Bromus tectorum*). *Southwestern Naturalist* 50:17-23.
- Ott, M., J. Ostheim, and W. C. Sherbrooke. 2004. Prey snapping and visual distance estimation in Texas horned lizards, *Phrynosoma cornutum*. *Journal of Experimental Biology* 207:3067-3072.
- Sherbrooke, W. C. 2004. Integumental water movement and rate of water ingestion during rain harvesting in the Texas horned lizard, *Phrynosoma cornutum*. *Amphibia-Reptilia* 25:29-39.
- Sherbrooke, W. C., and G. A. Middendorf. 2004. Responses of kit foxes (*Vulpes macrotis*) to antipredator blood-squirting and blood of Texas Horned Lizards (*Phrynosoma cornutum*). *Copeia*:652-658.

**HAYWIRE**

by M. Hawley



"AHHHH...BREAKFAST IN BED!"

